

Research Submission

Mild Head Trauma and Chronic Headaches in Returning US Soldiers

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Objective.—To determine the incidence and types of head or neck trauma and headache characteristics among US Army soldiers evaluated for chronic headaches at a military neurology clinic following a combat tour in Iraq.

Background.—Head or neck trauma and headaches are common in US soldiers deployed to Iraq. The temporal association between mild head trauma and headaches, as well as the clinical characteristics of headaches associated with mild head trauma, has not been systematically studied in US soldiers returning from Iraq.

Methods.—A retrospective cohort study was conducted with 81 US Army soldiers from the same brigade who were evaluated at a single military neurology clinic for recurrent headaches after a 1-year combat tour in Iraq. All subjects underwent a standardized interview and evaluation to determine the occurrence of head or neck trauma during deployment, mechanism and type of trauma, headache type, and headache characteristics.

Results.—In total, 33 of 81 (41%) soldiers evaluated for headaches reported a history of head or neck trauma while deployed to Iraq. A total of 18 (22%) subjects had concussion without loss of consciousness and 15 (19%) had concussion with loss of consciousness. Ten subjects also had an accompanying traumatic neck injury. No subjects had moderate or severe traumatic brain injury. Exposure to blasts was the most common cause of trauma, accounting for 67% of head and neck injuries. Headaches began within one week after trauma in 12 of 33 (36%) soldiers with head or neck injury. Another 12 (36%) reported worsening of pre-existing headaches after trauma. Headaches were classified as migraine type in 78% of soldiers with head or neck trauma. Headache types, frequency, severity, duration, and disability were similar for soldiers with and without a history of head or neck trauma.

Conclusion.—A history of mild head trauma, usually caused by exposure to blasts, is found in almost half of returning US combat troops who receive specialized care for headaches. In many cases, head trauma was temporally associated with either the onset of headaches or the worsening of pre-existing headaches, implicating trauma as a precipitating or exacerbating factor, respectively. Headaches in head trauma-exposed soldiers are usually migraine type and are similar to nontraumatic headaches encountered at a military specialty clinic.

Key words: headache, Iraq, traumatic brain injury, post-traumatic headache

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Headache is a common symptom after head or neck injury.^{1,2} Headaches precipitated by trauma often resolve within several weeks but in a minority of cases persist for many months or years.² There is an inverse correlation between the severity of head injury and the incidence of headaches.^{3,4} Headaches precipitated by trauma do not have defining clinical features and often resemble primary headache disorders.⁵⁻⁸ More recent data suggest that head or neck injury may increase the risk of developing chronic daily headache.⁹

Head and neck trauma is common in US soldiers deployed to Iraq or Afghanistan.^{10,11} Headache is also a frequent symptom among returning soldiers who sustained mild head injury while deployed to Iraq.¹² The temporal association between mild head trauma and headaches, as well as the clinical characteristics of headaches following mild head injury, has not been systematically analyzed in returning US soldiers. The primary purpose of this study was to determine the incidence and types of head or neck trauma among a cohort of US soldiers evaluated for chronic headaches at a military neurology clinic following a combat tour in Iraq.

METHODS

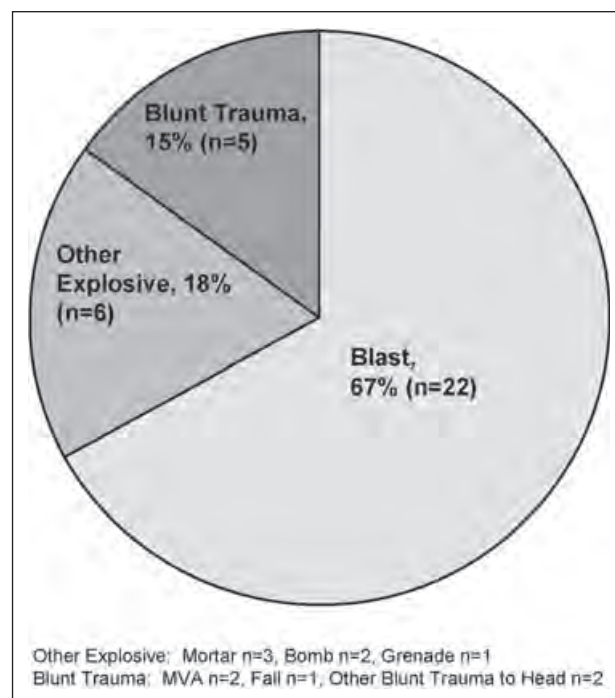
The Institutional Review Board at Madigan Army Medical Center approved the study protocol. A retrospective cohort study was conducted with 81 consecutive US Army soldiers who were evaluated between January and June 2006 in the Neurology Clinic at Madigan Army Medical Center for chronic headaches following a 12-month combat tour in Iraq. All subjects were members of the same brigade of approximately 3600 soldiers. Soldiers were eligible if they experienced headaches during deployment and continued to experience headaches for 3 or more months after returning from Iraq. The occurrence of head and/or neck trauma during deployment, mechanism and type of trauma, headache types, headache frequency, headache severity, headache duration, Migraine Disability Assessment Score (MIDAS),¹³ and post-traumatic stress disorder (PTSD) symptom checklist scores¹⁴ were obtained for each subject from the neurology clinic chart notes. Headaches were classified according to the International Classification of

Headache Disorders (ICHD) version 2.¹⁵ Concussion was defined according to the criteria suggested by Defense and Veterans Brain Injury Center Working Group on the Acute Management of Mild Traumatic Brain Injury in Military Operational Settings.¹⁶ Unpaired *t*-test or Fisher's exact test were used for testing differences between soldiers with and without a history of head or neck trauma.

RESULTS

The study population consisted of 73 men and 8 women. The mean age was 29.1 years. Head or neck trauma occurred during deployment in 33 of 81 (41%) of the soldiers referred to our clinic for headaches. The causes of head or neck trauma are shown in the Figure. The most common cause of head or neck trauma was exposure to blasts.

The types of traumatic injuries sustained during deployment are listed in Table 1. A total of 18 soldiers had concussion without loss of consciousness and 15 had concussion with loss of consciousness. Ten soldiers also experienced a whiplash or neck injury while deployed. Multiple head or neck in-



Fig—Mechanism of head or neck trauma. MVA = motor vehicle accident.

Table 1.—Classification of Traumatic Injuries in Soldiers With Head or Neck Trauma

Trauma classification	Number (%)
Concussion without LOC	18 (55)
Concussion with LOC	15 (45)
Multiple concussions	6 (18)
Whiplash or neck injury†	10 (30)

†These soldiers had a whiplash or neck injury in addition to a concussion with or without LOC.

LOC = loss of consciousness.

ries occurred in 6 soldiers. None of the subjects had sustained a moderate or severe traumatic brain injury (TBI). The temporal association between trauma and headaches is summarized in Table 2. In total, 12 (36%) soldiers had their headaches begin one week after a head or neck injury. Another 12 (36%) soldiers reported worsening of pre-existing headaches after head or neck injury.

The types of headaches, classified according to primary headache types, are summarized in Table 3. In all, 78% of headaches in soldiers with head or neck trauma were classified as migraines, mostly migraine without aura, and 15% were classified as tension-type headaches. Ten soldiers had more than one headache type. Among the 12 soldiers whose headaches began within one week of trauma, 9 had headaches classified as migraine (6 migraine without aura, 2 migraine with aura, 1 probable migraine), 2 had tension-type headaches, and one had a headache not otherwise specified. Five of these 12 sol-

Table 2.—Temporal Association of Headaches and Head or Neck Trauma

Temporal association	Number (%)
Headaches started less than <1 week after trauma	12 (36)
Headaches started 1 week to 1 month after trauma	1 (3)
Headaches started >1 month after trauma	3 (9)
Unspecified onset of headache after trauma	5 (15)
Worsening of pre-existing headaches	12 (36)

Table 3.—Headache Types in Soldiers With a History of Mild Head or Neck Trauma During Deployment

Headache type	Head or neck trauma, N (%)	No head or neck trauma, N (%)
Total	33	48
Migraine without aura	15 (45)	30 (62)
Migraine with aura	8 (24)	3 (6)
Probable migraine	3 (9)	5 (10)
Tension-type headache	5 (15)	13 (27)
Occipital neuralgia	5 (15)	3 (6)
Medication overuse headache	4 (12)	0 (0)
Headache NOS	7 (21)	7 (14)
Multiple headache types	10 (30)	16 (33)

NOS = not otherwise specified.

diers had multiple headache diagnoses. Two of the soldiers with migraine were also diagnosed with occipital neuralgia. One of these soldiers was diagnosed with medication overuse headache.

The clinical characteristics of the headaches of soldiers with head or neck trauma are compared with those of soldiers without head or neck trauma in Table 4. Severity and duration of headache attacks were similar between both groups. There was a non-significant trend toward greater headache frequency

Table 4.—Clinical Characteristics of Headaches in Soldiers With and Without Head or Neck Trauma

	No head or neck trauma	Head or neck trauma
N	48	33
Mean headache severity (0-10 scale)	7.1 ± 1.2	7.1 ± 1.5
Mean headache duration (h)	7.5 ± 5.2	8.8 ± 7.3
Mean headache days per month during deployment (days/months)	9.4 ± 9.4	14.5 ± 11.7
Mean headache days per month after deployment (days/months)	10.3 ± 8.0	11.9 ± 10.0
Mean MIDAS	26.8 ± 27.5	30.8 ± 44.3
Mean PTSD Checklist (PCL-C)	36.0 ± 14	34.6 ± 13.3

MIDAS = Migraine Disability Assessment Score; PCL-C = PTSD Checklist-Civilian version; PTSD = post-traumatic stress disorder.

among soldiers with head or neck trauma. In total, 11/33 (33%) soldiers with head or neck trauma and 8/48 (16%) soldiers without head or neck trauma met criteria for chronic daily headache, defined as 15 or more headache days per month for the last 3 months, but this did not achieve statistical significance ($P = .11$). Headache disability, as measured by the MIDAS, was similarly high in both groups. The mean scores on the PTSD symptom checklist did not differ between the 2 groups. In all, 7/33 (21%) soldiers with a history of head or neck trauma and 3/48 (6%) soldiers with no head or neck trauma scored 50 or higher on the PTSD symptom checklist, indicating a high likelihood for PTSD, but this difference did not quite achieve statistical significance ($P = .08$).

DISCUSSION

This study provides insight into the relationship between mild head or neck trauma and chronic headaches in US soldiers returning from a combat deployment in Iraq. We found that head or neck trauma, usually caused by exposure to blasts, occurred during deployment in 41% of soldiers undergoing evaluation for chronic headaches at a military neurology clinic. We also found that chronic headaches either began *de novo* shortly after trauma or were exacerbated by trauma in 30% of soldiers. These findings implicate traumatic injury of the head or neck as a contributing factor to chronic headaches in soldiers returning from Iraq.

Traumatic brain injury has been coined the signature injury of the Iraq war with up to 25% of soldiers evacuated from Iraq having a head or neck injury and 1 in 6 soldiers having symptoms of mild TBI after returning from deployment.^{10,11} There is concern about the cumulative effects of these head and neck injuries, particularly the relatively unknown effects of multiple exposures to blast explosions.¹⁷ Hoge et al¹² surveyed 2525 soldiers and found that nearly 15% of soldiers had a mild TBI while deployed to Iraq. After controlling for PTSD and depression, headache was the only symptom significantly associated with a history of mild TBI.¹² Our study further supports the notion that chronic headaches are a potential consequence of mild head and neck trauma in soldiers engaged in combat operations in Iraq.

It is worth noting that only 15% of our clinic-based military cohort with chronic headaches fulfilled the diagnostic criteria for chronic post-traumatic headache as defined by ICHD.¹⁵ Even among soldiers who sustained a concussion during deployment, less than half met ICHD criteria for chronic post-traumatic headache. Thus, while head injury is an important cause of chronic headaches in this population, the majority of soldiers referred to our neurology clinic for chronic headaches after a combat tour in Iraq have migraine. Our study was conducted prior to mandatory screening of all returning troops for TBI, which was implemented by the Department of Defense in 2007. It is anticipated that the TBI screening program will lead to an increase in the number of post-traumatic headache cases referred to specialty care.

As recently discussed by Evans,¹⁸ the ICHD diagnostic criteria for post-traumatic headache are somewhat arbitrary, particularly the requirement that the headache must begin within 7 days of trauma. Headaches caused by trauma could be misclassified as nontraumatic headaches if the latency period is longer than 7 days. We found that the majority of soldiers in our study who had *de novo* headaches following concussion reported onset of their headaches within 7 days of trauma. This observation indicates that the latency between head trauma and headache tends to be short in most cases (ie, less than a week) but does not exclude the possibility that post-traumatic headaches may develop after a longer latency period.

Headache occurs in 15–90% of patients after civilian head or neck trauma.^{1,19} In a study of 48 patients with post-traumatic headaches by Haas et al,⁷ 75% of chronic post-traumatic headaches met criteria for chronic tension-type headaches and 21% met criteria for migraine without aura. In contrast, we found that migraine was the most common headache type among deployed soldiers evaluated in our clinic for headaches starting within one week of mild head trauma. Additional studies are needed to better establish the headache profile of chronic post-traumatic headaches in soldiers.

We previously reported that 19% of soldiers in a combat unit deployed to Iraq experienced migraine

headaches.²⁰ The reasons for the increased prevalence of migraine headaches in deployed soldiers have not been elucidated although both physical and psychological factors are expected to play a role. The current study suggests that head or neck trauma may be one such factor that contributes to the high prevalence of migraines in deployed soldiers.

It has been proposed that post-traumatic headaches are mediated by the same underlying physiologic mechanisms as primary headaches.^{1,2,5,6,21} Consistent with this proposal, we found that the types of headaches, as well as the severity, duration, and disability of headaches, were similar between soldiers with and without head or neck trauma. We did observe a trend for greater headache frequency among soldiers who had sustained head or neck trauma. The latter observation, if confirmed by larger studies of military populations, fits with the findings of Couch et al, who found an association between head and neck injury and chronic daily headache within the general population.⁹

This study is limited by the small sample size, retrospective design, and clinic-based population. The findings of this study may not be applicable to all deployed military personnel or to all soldiers with headaches whether with or without a history of head or neck injury. Additional studies are needed to fully understand the interrelationship of head or neck trauma and chronic headaches in soldiers returning from deployment.

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